Field evaluation of a cylinder trap design for monitoring *Ephestia cautella*

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Abstract

The effectiveness of capturing *Ephestia cautella* in a chocolate factory using a cylinder trap design that incorporated an optical stimulus was investigated. The cylinder trap was compared with two commercially available units: a funnel trap and a sticky trap. It was found that the cylinder trap did not capture significantly more *E. cautella* individuals than the two commercially available traps, and that trap position rather than trap design was responsible for variation in capture rate. The cylinder trap design is unlikely to provide better detection of low-level infestation than do commercially available funnel and sticky traps for in-store pheromone monitoring programs.

Introduction

Pest management programs often use pheromone traps to monitor insect pest populations. There is a wide variety of trap designs used to monitor storage moths. These include sticky and funnel traps. Pheromone traps generally rely solely on the pheromone lure to attract male moths. However, Levinson and Hoppe (1983) found that storage moths also respond to optical stimuli. They showed that *Plodia interpunctella* (Hübner) and *Ephestia cautella* (Walker) preferentially flew to a silhouette of rectangular stripes in vertical suspension. Quartey and Coaker (1992) refined these findings and incorporated them into a cylindrical model trap that, when tested in a wind tunnel, proved to be more effective than commercially available traps in recapturing released *E. cautella* males. The aim of this study was to determine whether, in a food processing and storage environment, the cylinder trap designed by Quartey and Coaker (1992) was more effective in capturing *E. cautella* than two commonly utilised traps.

Materials and Methods

The cylinder traps (Fig. 1A) used in this study were designed after the 2-unit pheromone trap of Quartey and Coaker (1992). The traps were constructed of cardboard tubing and wire (2 mm diameter). The length of each unit was 23 cm with a 2 cm gap between the units. The tube diameter was 6.5 cm and the alternating black and white stripes were 7.5 mm wide. A small funnel (aperture 1.5 cm) was placed in the top of each unit. A single pheromone cap (International Pheromone Systems Ltd, U.K.) was placed 2 cm above the top unit. An insecticide pellet (2,2-dichlorovinyl dimethyl phosphate) was placed in each unit. The funnel traps (International Pheromone Systems Ltd, U.K.; Fig. 1B) and sticky traps (Pherocon II, Trécé Inc., Salinas CA; Fig. 1C) used identical pheromone lures.

Trapping with cylinder and funnel traps took place from September 1993 to March 1994 within an area (approx. 1400 m^2) of a chocolate factory that contained a resident population of *E. cautella*. Two traps of each design were placed alternately in the rectangular (5 × 8 m) pattern. Trapping with cylinder and sticky traps took place from March 1994 to July 1994 in the same area, with the same pattern. After recording the weekly catch, each trap was shifted one position anticlockwise. All traps were placed at a height of 3 m. Pheromone lures were replaced every 5 weeks and insecticide pellets every 10 weeks. Synergised pyrethrins were routinely applied to the factory (including the study site) every 1–3 weeks.

Temperatures in the trapping area remained relatively warm (28 ± 7°C) during the trial periods as a result of routine manufacturing activities that add heat to the environment.

For statistical analyses, data were transformed using log(x+1). Analysis of variance and Duncan's new multiple-range test were used to determine differences between trap design and position.

Results

The first trial compared the number of *E. cautella* captured in funnel and cylinder traps. Table 1 shows the number of moths caught in each trap at each trap position. Analysis indicated that there was no significant difference in the number of moths caught by each trap ($F=2.47$, $df=95$, $P>0.05$). Trap position did not significantly affect moth capture ($F=1.73$, $df=95$, $P>0.05$).

The second trial compared *E. cautella* capture in sticky and funnel traps. Table 2 shows the number of moths caught by the traps at each position. Again, there was no significant difference in the number of moths caught by each trap ($F=1.04$, $df=59$, $P>0.05$). However, in this trial, trap position did significantly affect moth capture ($F=9.56$, $df=59$, $P<0.05$) with significantly more moths captured at position C.

Discussion

Although the generally low number of individuals captured made an evaluation of trap design difficult, the results do suggest that the cylinder trap, incorporating an optical stimulus, does not provide a significantly higher capture rate of *Ephestia cautella* than either the funnel or sticky traps. Generally, the trap placed closest to a site of infestation captured more moths, regardless of trap design. This was particularly apparent in the second trial where an infested barrel of waste remained below position C for most of the trial. Both cylinder and sticky traps captured large numbers of moths when placed at position C, whereas traps placed in the other positions caught relatively few. In practical terms, both commercially available traps proved easier to handle than the

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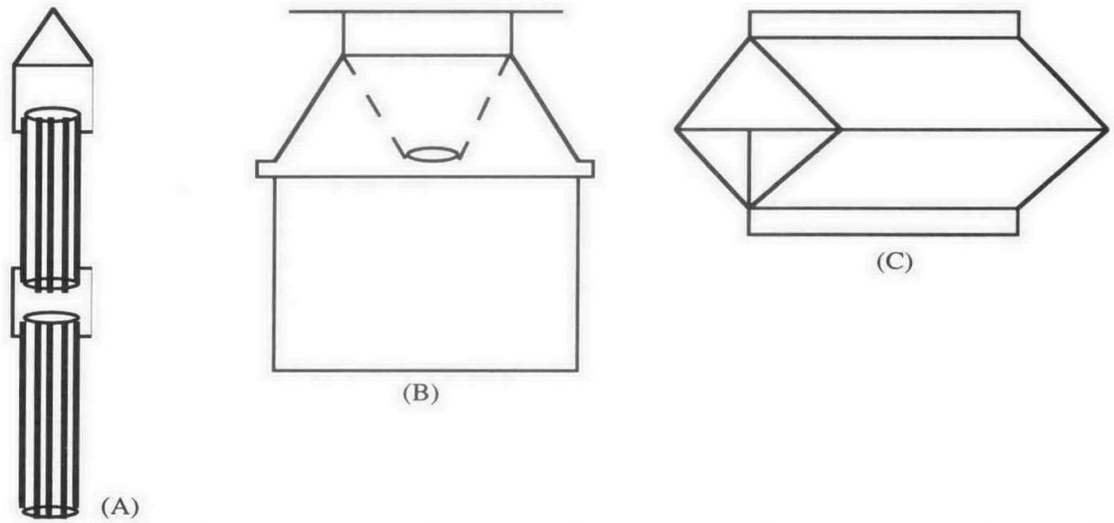

Fig. 1. Trap designs used to capture *Ephestia cautella* in a chocolate factory: A. cylinder; B. funnel; C. sticky.

Table 1. Total and mean number of *Ephestia cautella* caught in funnel (F) and cylinder traps (C) at each trapping position (A–D).

Position	Trap				Total	Moths (mean)/week (S.D.)
	F1	F2	C1	C2		
A	8	6	12	16	42	1.8 (2.0)
B	6	7	8	12	33	1.4 (2.1)
C	9	21	33	14	77	3.2 (4.2)
D	3	16	14	43	76	3.2 (6.7)
Total	26	50	67	85	228	
Moths (mean)/week		1.1	2.1	2.8	3.5	
(S.D.)		(1.6)	(3.5)	(3.6)	(6.6)	

Table 2. Total and mean number of *Ephestia cautella* caught in sticky (S) and cylinder traps (C) at each trap position (A–D). Total captures at each trap position followed by the same letter are not significantly different at the 5% level of probability (Duncan's new multiple-range test).

Position	Trap				Total	Moths (mean)/week (S.D.)
	S1	S2	C1	C2		
A	4	0	7	1	12a	0.8 (1.0)
B	3	4	4	5	16a	1.1 (1.2)
C	13	23	24	13	73b	4.9 (4.3)
D	1	3	3	10	17a	1.1 (1.2)
Total	21	30	38	29	118	
Moths (mean)/week	1.4	2.0	2.5	1.9		
(S.D.)	(2.1)	(3.5)	(3.6)	(2.2)		

cylinder traps. The length of the cylinder trap would be prohibitive in areas where stock is stored or moved close to ceilings. A reduction in the length would lead to a reduction in capture rate (Quartey and Coaker 1992) and therefore negate any possible photokinetic advantage the cylinder trap design may have over the commercially available traps. It is unlikely the cylinder trap design will provide better detection of low level infestation than do commercially available traps.

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